

## BICEPS CURL MACHINE

### Related Application

This application claims priority from U.S. Provisional Patent Application No. 60/299,538, filed 20 June 2001, entitled "Biceps Curl Machine."

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### Field of the Invention

The present invention relates generally to exercise machines, and more specifically to exercise machines that exercise the biceps muscles of a user.

### Background of the Invention

10       Exercise devices, and in particular weight training machines, typically include one or more mechanical members that the user repeatedly moves along a prescribed path for exercise. Conventionally, movement of the mechanical member is resisted in some fashion (often by weights) to render the movement more difficult and thereby intensify the exercise. The movement of the mechanical member determines what 15       muscle or muscle groups are to be involved in the exercise.

One popular exercise movement for weight training is the "biceps curl" motion, in which an exerciser substantially straightens his arms at the elbow to grasp a handle or other grasping device, and bends (or "curls") his arms while maintaining the upper arms or elbows in a substantially stationary position. This exercise 20       movement tends to work the biceps brachii, biceps brachialis, and forearm flexors of the user.

Some biceps curl machines include a frame that has a base and vertical uprights that rise from the base, a seat that is mounted to the frame, and a pair of movement arms that are pivotally mounted to and extend inwardly from the vertical 25       uprights. Support pads for the user's elbows extend inwardly from the vertical

uprights. The user sits on the seat, rests his elbows on the supports, grasps the movement arms with his arms straight, and curls his arms such that the movement arms pivot relative to the frame. This movement is resisted by weights or other resistance system.

5 In many biceps extension machines of this general configuration, planes  
defined by each vertical upright are generally parallel with one another. The axes of  
rotation of the movement arms tend to be substantially normal to these planes. As a  
result, the movement arms are positioned in front of a seated user. This configuration  
may be inconvenient for a user as he enters the machine; often the movement arm  
10 must be moved out of the way in order for the user to sit. In addition, the parallel  
relationship of the axes of rotation may inhibit complete contraction of the biceps  
muscle.

## **Summary of the Invention**

15 The present invention is directed to a biceps curl machine that can enable a user to enter the machine easily and can encourage complete contraction of the biceps muscles. In some embodiments, the machine includes: a frame configured to rest on an underlying surface; a seat mounted to the frame and configured to receive a seated user; a pair of support pads mounted to the frame forwardly of and above the seat, each of the support pads being positioned to engage one of the upper arms and the elbows of the seated user; a pair of movement arm units pivotally interconnected with the frame and movable about respective generally horizontal axes of rotation; and a resistance system connected with the movement arm units. Each of the pair of movement arm units is configured to engage the forearms and/or the hands of the user and is movable between an extended position, in which the seated user's arms are substantially straight, and a curled position, in which the user's arms are bent. The axes of rotation form an angle of between about 115 and 155 degrees. The resistance system provides resistance to rotation of the movement arm units as they move from the extended position to the curled position. In this configuration, the machine can enable an exerciser to easily enter the machine for exercise and can encourage complete contraction of the biceps.

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As another aspect, the present invention is directed to a biceps curl machine that can provide more efficient exercise of the biceps muscles through selective

positioning of the user's elbows. Such a biceps curl machine comprises: a frame configured to rest on an underlying surface; a seat mounted to the frame and configured to receive a seated user; a pair of support pads mounted to the frame forwardly of and above the seat, each of the support pads being positioned to engage 5 one of the upper arms and the elbows of the seated user; a pair of movement arm units pivotally interconnected with the frame and movable about respective generally horizontal axes of rotation, each of the pair of movement arm units being configured to engage the forearms and/or the hands of the user, each of the pair of movement arm units being movable between an extended position, in which the seated user's arms 10 are substantially straight, and a curled position, in which the user's arms are bent; and a resistance system connected with the movement arm units that provides resistance to rotation of the movement arm units as they move from the extended position to the curled position. The elevation of the seat and the support pads are such that, when a user is seated and the user's elbows or upper arms engage the support pads, the user's 15 upper arms are angled upwardly from shoulder to elbow at an angle of at least 10 degrees. This configuration can allow more complete contraction of the biceps muscles of the user.

#### Brief Description of the Figures

20 **Figure 1** is a perspective view of a biceps curl machine of the present invention.

**Figure 2** is a side view of the machine of **Figure 1**, with the extended exercise position shown in bold line and the curled position shown in phantom line.

25 **Figure 3** is an exploded view of the frame, cam assemblies, handle assemblies, and seat assembly employed with the machine of the present invention.

**Figure 4** is a perspective view of the weight stack employed with the machine of the present invention.

**Figure 5** is a schematic view of the belt-pulley system of the machine of the present invention.

30 **Figure 6** is a partial top view of the frame of the machine of the present invention.

**Figure 7** is a partial side view of the frame and seat support member of the machine of the present invention.

Figure 8 is a graph plotting resistance as a function of cam angle for certain embodiments of the present invention.

#### Detailed Description of the Invention

5 The present invention will now be described more fully hereinafter, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the  
10 invention to those skilled in the art. In the drawings, like numbers refer to like elements throughout. Thicknesses and dimensions of some components may be exaggerated for clarity.

15 A biceps extension machine, designated broadly at 10, is illustrated in Figures 1-7. The machine 10 includes a frame 11, a weight stack 12, a seat assembly 13, two movement arm units 40, and two pulley systems 50, 60. These components are described in more detail below.

20 Referring to Figures 1-3, 6 and 7, the frame 11 includes a base 14 with legs 14a, 14b and a cross member 14c, rear uprights 15a, 15b that extend upwardly and forwardly from rear portions of the legs 14a, 14b, and front uprights 16a, 16b that extend upwardly from front portions of the legs 14a, 14b. The rear and front uprights 15a, 16a define plane P<sub>1</sub> and the rear and front uprights 15b, 16b define a plane P<sub>2</sub>. The planes P<sub>1</sub>, P<sub>2</sub> form an angle  $\alpha$  (see Figure 6) of between about 20 and 70 degrees, with an angle  $\alpha$  of between 35 and 45 degrees being preferred, and an angle  $\alpha$  of about 40 degrees being most preferred. This angular arrangement can provide easy  
25 access into the machine 10 for a user. As noted above, prior machines, particularly those that have frame arms and uprights that are parallel to one another, may require that the movement arm be raised in order for the user to be seated for exercise. A respective pad arm 17a, 17b extends inwardly and upwardly from each front upright 16a, 16b to terminate at a position just below the horizontal portions of the rear uprights 15a, 15b. A support pad 18 is attached to the upper end of each pad arm  
30 17a, 17b in position to engage the upper arms or elbows of the user. A seat mounting platform 19 is mounted to the forward edge of the cross member 14c.

Those skilled in this art will appreciate that the frame 11 may take alternative forms. For example additional uprights may be employed, or certain components may be formed from multiple pieces.

Referring now to **Figures 1, 2 and 4**, the weight stack 12 is positioned on the leg 14b and includes a plurality of weights 20 arranged in a vertical stack. Two guide rods 21a, 21b extend vertically from the leg 14b to the upper portion of the rear upright 15a; the weights 20 have apertures that receive the guide rods 21a, 21b such that the weights are free to slide vertically thereon. An elongate lifting member 22 extends through an aperture in the center of each weight 20. The lifting member 22 includes apertures 23 that can receive a pin 24. An auxiliary weight stack 25 includes a pair of lighter weights 26 that slide on a guide rod 27 that also extends from the leg 14b to the upper portion of the rear upright 15b. An auxiliary weight bracket 28 is attached to the uppermost weight 20 and to a stack pin 28a that fits within a groove in the guide rod 27 and includes apertures to receive a pin 29 for the selection of weights 26.

Those skilled in this art will appreciate that other resistance systems may be employed with the present invention. For example, other weight stack configurations, friction-imparting devices, variable viscosity devices, air drag-based resistance devices, and the like, may also be employed with a machine of the present invention. Exemplary resistance devices include those illustrated in U.S. Patent Nos. 5,810,696; 4,708,338; 4,720,093; 5,033,733; 4,542,897; 4,298,893; 4,805,901; 4,790,528; 4,786,049; 5,031,900; 4,775,145; 4,589,656; and 4,659,074, the disclosures of each of which are hereby incorporated herein by reference in their entireties.

The seat assembly 13 includes a support member 33 that is mounted to the seat mounting platform 19 and extends upwardly and rearwardly therefrom. Preferably, the support member 30 reclines at an angle  $\beta$  (**Figure 7**) with the underlying surface that is between about 60 and 80 degrees, and more preferably between about 70 and 80 degrees, with 75 degrees being most preferred. A track 31 with a serrated front surface 32 is mounted to the front surface of the support member 30. A seat bracket 33 is mounted to the track 31 (**Figure 3**) such that the rear edge thereof mates with one of the serrations in the track front surface 32. A seat 34 is mounted on the upper surface of the seat bracket 33. The interaction between the seat bracket 33 and the serrations in the track front surface 32 enable the seat 34 to be adjusted vertically to a

number of discrete positions along the track 31. A backrest 35 is mounted to a backrest support 36, which is in turn mounted to the support member 30 above the seat 34; the reclining angle of the backrest support 36, and in turn the backrest 35, can be adjusted as desired.

5 Referring to **Figures 1** and **3**, each of the movement arm units 40 is pivotally attached to the frame 11; only one movement arm unit 40 will be described in detail herein, as the movement arm units 40 are essentially mirror images of one another. A cam 41 is pivotally attached to an upper portion of each front upright 16a, 16b via a pivot pin 41a that extends through an aperture in a respective front upright 16a, 16b.

10 The cam 41 has a camming surface 41b. A lever arm 42 extends forwardly and slightly upwardly from each cam 41 and terminates in a hollow, elongate bearing hubs 43. An S-shaped handle 49 includes a grip portion 44, an intermediate portion 45 that merges with the grip portion 44, and a mounting portion 46 that is received within and pivots relative to the bearing hubs 43 of the cam assembly 40. Thus, each handle 49 is free to pivot relative to its corresponding lever arm 42 about a respective axis of rotation **A1**, **A2**, and each cam 41 is free to pivot relative to its corresponding upright 16a, 16b about a respective axis of rotation **B1**, **B2** that is substantially parallel with its corresponding axis of rotation **A1**, **A2**. Notably, the axis **A1** defines an angle  $\gamma$  (Fig. 6) which is between about 115 and 155 degrees with the axis **A2**, and more preferably is between 135 and 145 degrees, with 140 degrees being most preferred; consequently, the axis **B1** forms a similar angle with the axis **B2**. Also, it is notable that the axes **A1**, **A2**, **B1**, **B2** are substantially perpendicular to the respective planes **P<sub>1</sub>**, **P<sub>2</sub>** defined by the arms 14a, 14b and their respective rear and front uprights 15a, 15b, 16a, 16b.

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The configuration of the camming surface 41b controls the resistance curve experienced by the user during exercise. Fundamentally, it is typically desirable to vary the resistance experienced by the user at different points during movement; otherwise, the magnitude of resistance necessary to provide a strengthening workout to a muscle or muscle group may be too high to enable the user to move the movement arm unit 40 through positions within the full range of motion in which the user enjoys a lower mechanical advantage. In the illustrated embodiment, the non-circular camming surface 41b of the cam 41 causes the resistance experienced by the user to follow the resistance curve illustrated in **Figure 8**. Those skilled in this art will recognize that, although a

non-circular cam is preferred to provide a varying resistance curve to the machine 10, other structures, such as four-bar linkages and the like, can also be employed to vary the resistance of the machine during exercise.

The movement arm units 40 are interconnected with the weight stack 12 via 5 two pulley systems 50, 60 (Figure 5). The pulley system 50 includes a belt 51 that is attached to the forward portion of the perimeter of one cam 41. The belt 51 follows the contour of the camming surface 41b as the belt travels rearwardly, then extends upwardly to a pulley 52 mounted to an upper portion of one rear upright 15a, extends downwardly to a pulley 53 mounted to one end of a floating pulley bracket 54 (seen 10 best in Figure 3), extends horizontally to a pulley 55 mounted to the other end of the floating pulley bracket 54, extends upwardly to a pulley 57 mounted on the opposite rear upright 15a, and terminates by following the contour of the other cam 41 and attaching to the forward perimeter portion thereof. The pulley system 60 includes a belt 61 that is attached to the lifting member 22 and extends upwardly over a pulley 15 62 attached to a forward portion of a pulley mounting bracket 63 attached to the upper portion of the frame 11, rearwardly to a pulley 64 attached to the rear portion of the pulley mounting bracket 63, downwardly to a pulley 65 attached to a bracket 69 attached to the lower end of the rear upright 15a, horizontally to a pulley 66 mounted via a pin 67 to the cross member 14c, and upwardly to fixedly mount to a pin 68 20 mounted to the lower central portion of the floating pulley mounting bracket 54.

Those skilled in this art will recognize that, although the pulley systems 50, 60 are employed to interconnect the weight stack 12 and the movement arm units 40, other systems that connect the movement arm units and the chosen resistance system, such as cables, chains, and the like, may be suitable for use with the present invention.

25 In operation, the user selects a desired weight by inserting the pin 24 into an aperture in the individual weight 20 that provides the user with a stack of weights 20 that corresponds to the desired exercise resistance (and, if desired, inserts the pin 29 to select one or both auxiliary weights 26). The user then adjusts the seat assembly 13 to the desired height (preferably one in which the user's elbows align with the axes of 30 rotation B1, B2) by manipulating the seat 34 until the seat bracket 33 mates with a desired serration on the track front surface 32. The user may also adjust the angle of the backrest 35. The user then sits upon the seat 34, rests his back against the backrest 35, grasps the grip portions 44 of the handles 49, and places his elbows on the pads 18 with his arms extended (see Figure 2 in solid line).

It is preferred that the seat height be such that the user's upper arms are angled upwardly from shoulder to elbow; an angle of at least 5 degrees is preferred, with an angle of at least 10 degrees being more preferred. Doing so can have the effect of stretching the biceps and latissimus dorsi. Because both heads of the biceps brachii 5 originate from locations on the scapula (located behind the shoulder joint) and insert on the radius, raising the elbows can provide a posture in which contraction of the biceps can be complete (in contrast, a lower position of the elbows may cause that head of the biceps to be less than completely contracted even when the user can flex no further during the exercise). More complete contraction of the arm during flexure 10 can increase exercise intensity and efficiency. The coracobrachialis can also benefit from raising of the elbows.

Exercise is performed by the user bending his arms at the elbows, thereby drawing the grip portions 44 of the handles 49 toward his shoulders to a curled position (see **Figure 2** in phantom line). This movement causes the cams 41 to pivot relative to the rear uprights 15a and take up some of the belt 51 (when viewed from the right side of the user, both cams 41 pivot counterclockwise). As the cams 41 take up the belt 51, the shortening of the belt 51 causes the floating pulley bracket 54 to rise, which in turn draws the end of the belt 61 attached to the pin 67 of the floating pulley bracket 54 upwardly. As the end of the belt 61 rises, it draws the selected 15 weights 20 in the weight stack 12 upwardly, thereby providing resistance to the user. This exercise movement exercises the biceps brachii, biceps brachialis, and forearm 20 flexors. Once the user has bent his arms, he then straightens them to return the movement arm units 40, the weights 20 and the pulley systems 50, 60 to their original positions.

25 As noted above, the relationships between the axes of rotation **A1**, **A2** and **B1**, **B2** are defined by the angle  $\gamma$ . When the angle  $\gamma$  is of the magnitude described above, exercise can be more intense and efficient because, similar to that described for the raising of the elbows, the origin of the biceps within the shoulder can allow arm flexure can be more complete.

30 The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are

possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention.